
Technical notes

Grapevine Virus A and Shiraz Disease – What do Australian growers need to know?

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Background

Shiraz is Australia's most planted red wine-grape variety, and is the basis of many of Australia's most prestigious wines. This variety is, however, sensitive to a number of viruses including *Grapevine virus A* (GVA), which is associated with the disorder known as Shiraz Disease. GVA is a *Vitivirus* (family: *Betflexiviridae*) and a member of the group of grapevine viruses known as the 'rugose wood complex' group. Other members of this group include *Grapevine viruses B, D, E, F* and *Grapevine rupestris stem-pitting-associated virus* (GRSPaV).

Symptoms

Symptomatic vines affected by Shiraz Disease show the following characteristics:

- Their leaves turn red in late autumn and remain on the canopy throughout the winter (Figure 1).
- They show restricted spring growth (RSG) compared with unaffected vines growing in the same row (Figure 2).



Figure 1. Shiraz Disease in Shiraz vines six years after being grafted onto Chardonnay rootstock. The symptomless Chardonnay was infected with GVA.

- Occasionally, longitudinal cracking is seen on unligified one-year-old wood of Shiraz, but not on the rootstock (Figure 3). Canes also show a mosaic of unligified wood (Figure 3).

History

GVA-associated Shiraz Disease was first reported in South Africa by Corbett and Wiid (1985). In Australia, the first evidence of Shiraz Disease was obtained from a Clare Valley Shiraz sample sent to Waite Diagnostics in September 1998. Healthy Shiraz samples from the



Figure 2. Shiraz vine grafted on GVA-positive Chardonnay showing restricted spring growth (vine at far right hand side of image).

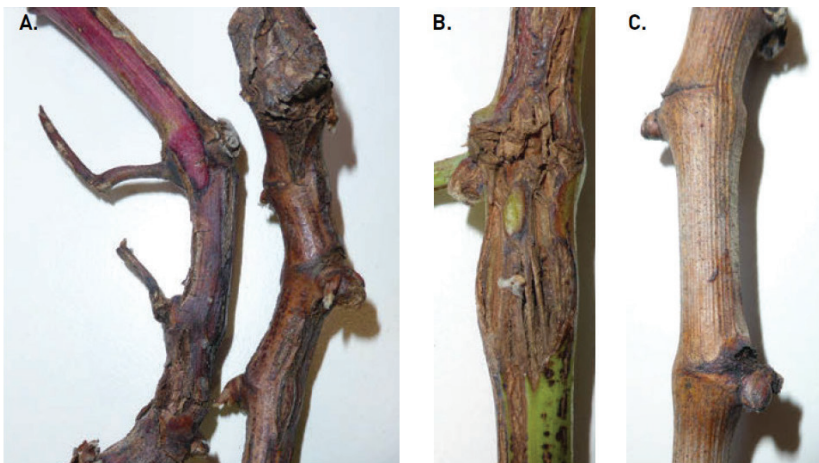


Figure 3. Symptoms of Shiraz Disease on Shiraz canes in autumn: (A) cracks on unligified cane; (B) cracks and swelling on Shiraz grafted onto Chardonnay; (C) a healthy cane (Habibi et al. 2016)

same row tested negative for GVA. At the same time, samples of two other varieties from the same vineyard (Cabernet Sauvignon and Crouchen) tested positive for GVA, but unlike the Shiraz, were symptomless (unpublished records from Waite Diagnostics). Shiraz Disease has so far only been reported in Australia and South Africa. This could be related to the genetic variability of GVA, which has three major genetic groups. Of these three groups, group II has been detected in both in Australia and South Africa and has been linked to Shiraz Disease by DNA testing (Goszczynski and Habili 2012, Qi Wu, pers. comm.). Genetic group I, mostly detected in Europe, is not associated with Shiraz Disease symptoms.

Not just in Shiraz – sensitive and tolerant grapevine varieties

Shiraz, Merlot, Malbec, Ruby Cabernet and Sumoll have all been found to show the symptoms of Shiraz Disease (Habili and Randles 2004). Further research may reveal other susceptible varieties. White varieties, rootstocks and a number of red varieties including Cabernet Sauvignon, Grenache and Nero D'Avola do not display symptoms when infected with GVA. To avoid the risk of Shiraz Disease, sensitive varieties should not be grafted onto GVA-affected varieties.

Other viruses associated with Shiraz Disease

In Shiraz Disease-affected vines, additional viruses other than GVA are commonly detected. One example of this is GRSPaV, which is present in more than 95% of Australian vines. The role of this symptomless minor virus is not known. Leafroll-associated viruses are also commonly found in combination with GVA in vines affected by Shiraz Disease.

How is GVA spread?

GVA, a phloem-limited virus, is not transmitted by horticultural tools. *Vitis* spp. are the only natural hosts of the virus. It has been reported that mealybugs and soft scale insects can transmit GVA along with leaf-roll associated viruses (GLRaV-1 and GLRaV-3) from mixed infected grapevines (Bertin et al. 2016). Infection also occurs by grafting sensitive varieties onto GVA-infected rootstocks. For example, Shiraz vines grafted onto GVA-affected but symptomless varieties (such as Chardonnay, Riesling, Cabernet Sauvignon and Grenache) show the symptoms of Shiraz Disease and test positive for GVA.

One example of insect-spread GVA occurred in a McLaren Vale vineyard where grapevine scale insects (*Parthenolecanium persicae*) were highly abundant on GVA-infected Merlot vines (Figure 4). The Merlot block was adjacent to a Shiraz block which showed the spread of Shiraz Disease from the Merlot in a clustered pattern. In the nucleic acid extracts of scale insects collected from the infected Merlot vines, both GVA and GLRaV-3 were detected and it appeared that the concentration of leafroll virus was higher than GVA in the bodies of

crawling nymphs of scale insects. This has recently been confirmed by a quantitative assay (qPCR). It appears that the same species of mealybug or scale insect can transmit both viruses.

Economic impact

Shiraz Disease can have a major economic impact on affected vineyard businesses. For example, six years after grafting Shiraz onto GVA-positive Chardonnay (top-working, Figure 1) at McLaren Vale, the vineyard lost 98% of its yield (Habibi and Randles 2012). At Langhorne Creek, a large block of Shiraz top-worked onto Chardonnay developed Shiraz Disease in 20% of its vines, displaying restricted spring growth. According to the grower, the cost of removing infected vines, replanting and loss of crop, was estimated to be around \$400,000 for a 6-ha block. An independent vineyard consultant assessed the damage cost at \$70,000/ha which was consistent with the above estimate.

Management strategies

To minimise the risk of economic damage from Shiraz Disease, there are a number of steps that growers can take:

1. Use virus-tested planting material when establishing new vineyards or when conducting top-working. It is important that rootlings are purchased from accredited nurseries with a virus testing program.
2. Before planting or grafting susceptible varieties, make sure that the neighbouring blocks are free of Shiraz Disease-associated viruses. If removing GVA-positive vines from nearby is not possible, a non-susceptible variety should be planted or grafted instead; for example, a white variety or a tolerant red variety such as Cabernet Sauvignon, Grenache or Nero D'Avola, rather than Shiraz, Malbec and Merlot.



Figure 4. *Parthenolecanium persicae* (grapevine scale) on canes of Shiraz

3. Remove and replant any vines that show definitive symptoms of Shiraz Disease. This protocol has been practised in South Africa and New Zealand for GLRaV-3 for years. Virus testing is an option for vines showing less definitive symptoms.
4. In vineyards where GVA is known, regularly monitor for insect vectors and adopt appropriate control measures.
5. If GVA is present, before removing affected vines and replanting, use insecticides to control the mealybug and scale and reduce the background levels of these insects. Remove cover crops that act as host plants to mealybug and scale.
6. When removing vines try to remove as much root matter from the top 30 cm of the soil as possible.

Future research

Further research in collaboration with industry is needed to tackle several key questions about the devastating effects of Shiraz Disease. Key researchable questions include:

- What is the economic threshold for removal of infected vines?
- Which virus vectors are active in Australian vineyards and what are their natural enemies?
- How widespread is GVA-associated Shiraz Disease in Australia?
- Are herbicides effective at reducing virus-infected root material which is the food source of mealybug vectors living in soil?

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